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Medicine in South India

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A three-month sabbatical allowed a superficial overview of Indian medical history and practice. As in Western nations, cost is a major determinant of health care delivery in India; poverty and fiscal shortages, however, deny care to many. The education of Indian physicians is similar to that in Western nations and a high level of clinical competence is seen. However, physician compensation is woefully low by Western standards. India possesses its own indigenous medical systems, purported to be the oldest in the world and predating Hippocrates by several millenia. Most Indians are cared for by native practitioners whose medical techniques are intricately related to the Hindu and Islamic religions. Many of their herbal medicines have been assimilated into contemporary Western practice. Diseases unknown to us except by textbooks are commonly seen and effectively treated. On the other hand, Western diseases such as coronary arteriosclerosis are not uncommon in a land of massive overpopulation and malnutrition. The humbling aspect of this experience is the realization that medical practice dating back several millenia can be made more modern and carried out competently by contemporary physicians. A Western physician working in India finds an unparalleled variety of disease in a totally different medical-religious environment allowing him to reorganize his priorities and to rediscover himself in the world within which he lives.

ADMITTEDLY, three months spent abroad in medical institutions in India hardly gives a physician wisdom or sufficient background to judge a country's system of health care delivery. Additionally, understanding of Indian medicine is complicated by many factors foreign to Westerners: religion, caste, astrology and, not in the least, economics. My comments, therefore, are impressions of Indian medical history and personal documentations of my own fascination with Indian medical care which is so different from that of our country.

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Health Care Delivery

The delivery of health care in India is similar to that in the West. Private physicians care for private patients. Those unable to afford private care can avail themselves of government hospital facilities. However, ever apparent is the financial limitation to scientific medical care. Indian physicians are frankly aware of the costs of health services. Expensive medicines such as the newer antibiotics, newer catecholamines and cancer chemotherapeutic drugs are seldom used. Laboratory tests are kept to a minimum.

The cost of a hospital bed in South India is about three dollars per day. Half the cost is for

nursing care and food which may be supplied by the family to reduce the hospital bill. This contribution by the family is a constant factor in aid to the ill. Families will care for the patient, cook his food, sleep beside him on the floor and tend to his needs in part because of a paucity of funds but in the main because of the devotion and care ingrained by centuries of charitable habit. In private hospital facilities in South India such common studies as x-ray films, electrocardiograms and blood counts must be paid for in cash before they are made. Drugs must be purchased before they are taken.

There is no health insurance in India. There is no prepaid medical care except that provided by large industries, large farms or plantations. Those people who do not have the wherewithal to afford the care which we consider standard, frequently leave hospitals to take their chances at home. No legal system protects a patient from poor care or forces hospitals or physicians to tend him. Malpractice suits are unknown on the Indian subcontinent.

Delivery of health care at specialized centers represents an additional problem. Referral hospitals in subspecialty areas draw from a large geographical area. In India, where there exist 15 major languages from Hindi, Urdu, Bengali and Maharati in the north to Tulugu, Tamil and Malayala in the south, few physicians can provide that essential part of any medical evaluation, the clinical history. Different Indian states act linguistically as different countries. For instance, in Tamil Nadu, the Sanskrit-Dravidian language contains 247 consonants, 12 vowels and a host of idioms which create a linguistic nightmare for western philologists. Consequently, in the referral medical community, English becomes the link language between physicians, nurses and paramedical personnel to interpret for patients.

Training

The training of an Indian physician begins at what we would consider the second year of high school or pre-university. Five and a half years transpire before he achieves his MBBS degree. He can then practice or can take one to two years of internship or house officership, as it is frequently called. To obtain the MD degree in medicine requires an additional three years (tantamount to residency), following which there is a certifying examination. If he wishes to subspecialize, he will then apply for and if accepted begin another two years of training for the DM or subspecialty degree.

Indian medical students do not study a core curriculum, as do students in most American medical schools, but study individual subjects in their basic science years. They are assigned to patient workup and hospital follow-up care as clinical clerks but do not prescribe or treat until they receive their graduate or MBBS degree. Competition for MD and DM degrees is keen at the leading medical centers, as would be expected. Those graduates working for advanced degrees impressed me as excellent clinicians. Many, however, on completion of training had difficulty in finding hospital positions. Well-trained Indian physicians find it difficult to work in the rural areas where indigenous practitioners abound.

Most allopathic or Western-oriented Indian physicians are trained in their own country. The capability of medical personnel I found at university centers was as good as in the West and physicians were possessed of considerable technical, teaching and practice skills.

In medical training programs in India a significant number of students are women. Many women physicians head clinical departments. With "arranged marriages" still common, men and women physicians are frequently matched. It was in a woman's medical college in Vellore that I principally worked (Figure 1 shows the states where I worked).

The Christian Medical College in Vellore was the vision and accomplished fact of a Cornell medical graduate of 1899, Dr. Ida Scudder, a member of a pioneer missionary family in India whose relatives still give their lives and talents and inspire others to do so. Her facility in Vellore in Tamil Nadu State, initially a hospital for women, grew into a nursing school, a medical college affiliated with the University of Madras, an eye hospital, and a world famous leprosarium at Karigiri where basic clinical and pathologic research in leprosy was followed by similarly unique reconstructive surgical procedures.

Indian physicians are poorly compensated by Western standards. In South India a full professor makes what is equivalent to less than $200 per month. Private practice is allowed to University physicians, but by contract all proceeds revert to the Medical College. Government-employed physicians, however, have the opportunity to practice privately using their homes as offices. Their total

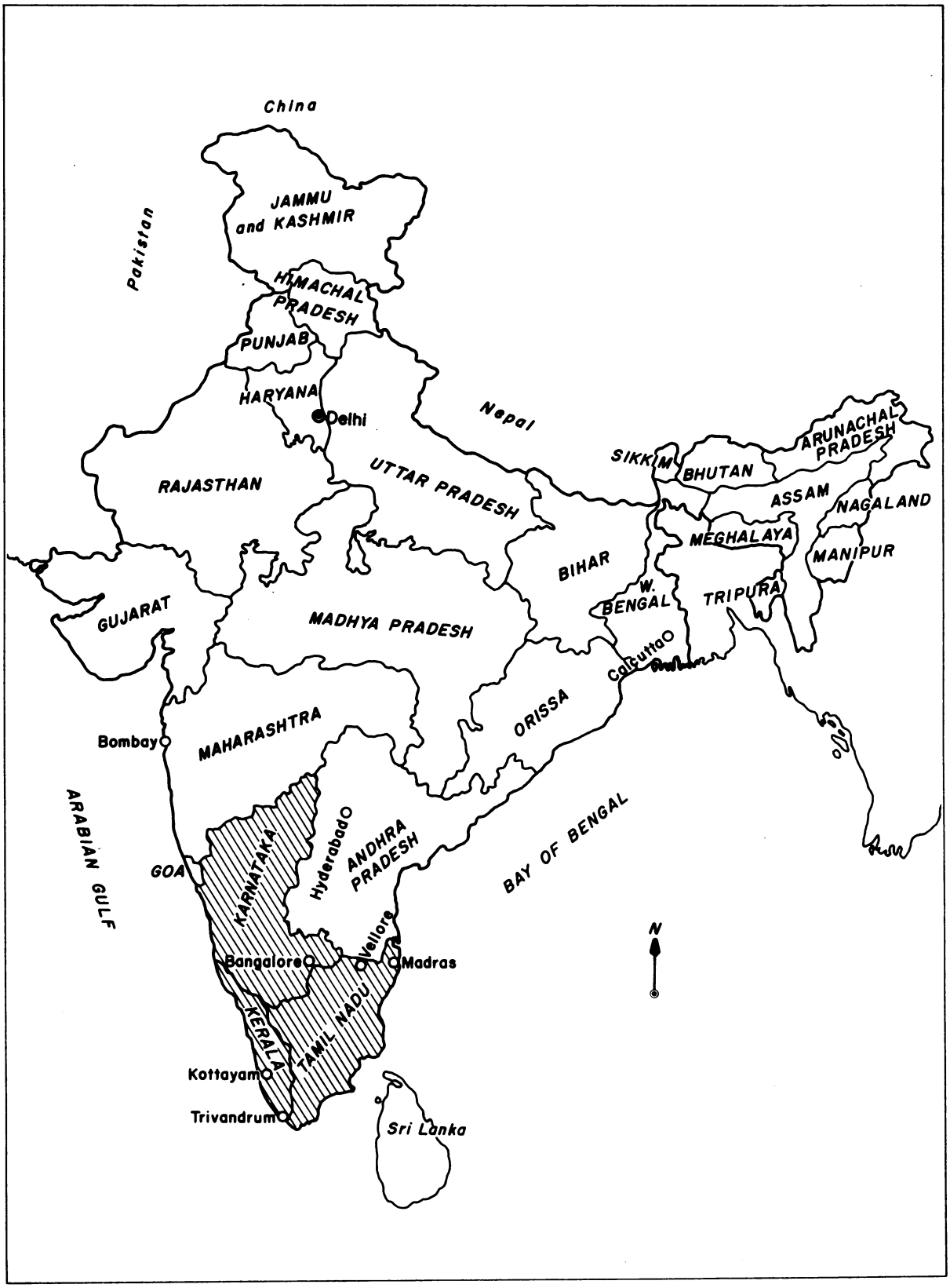

Figure 1.—The Indian subcontinent, smaller than the United States, but with 640 million people speaking 15 major languages, is depicted in this drawing. Shaded areas indicate states where the author worked.

income allows them to live well by Indian standards within their community but allows little latitude to travel. Transportation except by bus or railroad is expensive. Travel outside the country is prohibitively expensive and a limit of rupees brought out of the country is imposed by the government. A frequent lament of skilled Indian physicians was their inability to leave the country to travel abroad for training seminars or postgraduate specialization because the travel costs were high and it was difficult to find programs to accept them and pay their expenses. One cannot really criticize those young Indian doctors who find a way to leave their country, work at bare survival wages abroad but stay to make a living in an area where the standard of living is higher.

Indigenous Medical Systems

All medicine has its roots in ancient mythology and arose probably as an adjunct to magic. India is unique in possessing its own indigenous medical systems. The two principal schools are Ayurvedic and Unani-Tibb. Just as Varanasi (Benares, the holiest city of the Hindus) may be the oldest continuous actively functioning city in the world, native Indian medical systems lay proper claim to a pharmacopeia and a codified practice of the healing arts older than Greek or Egyptian ones. The earliest recorded physician (Imhotep, architect and advisor to the High Kingdom monarch, King Zozer) practiced in approximately 3150 BC. The Indian Vedas, verses and writings upon which Indian indigenous medicine is based, are said to predate this time.

The earliest recorded Indian texts, the Rgveda and Atharveda, were compiled about 3000 BC, but evidence suggests that the Ayurveda concepts preceded this time and were developd by the early builders of the Indus Valley civilization. Ayurvedic texts are called Samhitas and express the concept of Tridosa, the three bodily humors of force, fire and cold whose imbalance produces disease states. Ayurvedic medicine attempts to regulate this imbalance through changes in diet, climate, massage, hydrotherapy, herbs and metals such that proper health can be restored. Yet more than a healing art, Ayurveda is a total social system concerned with the prolongation of healthy life and prevention of disease and senility and only secondarily concerned with curing illnesses. It exists as a philosophy of living properly to sustain health within the confines of the Hindu faith.

Ayurvedic translated from Sanskrit means "life knowledge." Its written tradition can be traced only as far as 600 BC but its noncodified practice appears to predate its first writings by three millennia. Historians and antiquarians admit that India was the birthplace of medicine and surgery, if not also the origin of the earliest Greek philosophy. The medicine of the Arabs is attributed to Western migration of Vedic practitioners. Avicenna (Abu Ali al-Hussein ibn Abdallah ibn Sina), a distinguished Persian physician of the ninth century AD and composer of the revered medical *Canon* (Q'anun), in his writing quotes the Vedic physician Charaka. Hippocrates, the "father of medicine," whose treatises were compiled from the fourth century BC to the second century AD, borrowed much of his materia medica from the Hindus. The father of Indian medicine, Rishi Atreya, wrote in 1350 BC that "the beginning of the art of healing is as ancient as life itself."

Ayurvedic originates from a Veda or song of the healing art supposedly of divine origin and expostulated by Brahma, the first member of the Hindu triad. The first treatises in Ayurveda were written about 500 to 600 BC. Charaka "the internist" in the first century AD described treatments for most common infectious diseases and composed an encyclopedia of medicine still used in India. Bhava Misra (1550 AD) purportedly mentioned the proper circulation of the blood, 100 years before Harvey's treatise. Susrutha, a professor at the University of Benares, basically a surgeon, accurately described anatomic dissections in the fifth century AD and was concerned with personal hygiene and antisepsis in surgery. His knowledge of obstetrics, forceps deliveries and caesarian section was extensive. He mentioned the use of medicinal liquors to produce insensibility to pain. He emphasized diagnosis by palpation of the pulse, auscultation and analysis of urine. He described vaccination for infectious diseases and mentioned hypnotism for treatment of the sick. His description of a surgical operation is interesting. The surgeon first prays. He keeps his hair and beard trimmed short and his nails short and clean. His dress is clean, as is the surgical room, wherever it may be, and the operating area is cleansed and fumigated with "disinfecting vapors" before and after operation. For suture material Susrutha used strings of dried ants. His descriptions of reconstructive surgical procedures on the face and limbs may form the initial description of modern plastic surgery.

Ayurvedic roots exist in Hindu philosophy and are codified in Sanskrit treatises, especially those attributed to Susrutha and to Charaka. These Samhitas, works in medicine and surgery, passed down through hundreds of generations, were eventually put to paper about 600 BC and describe the eight-limbed science of longevity as practiced by the Vedic physicians. These limbs included medicine; surgery; ear, nose and throat disease; pediatrics; treatment of poisoning; illnesses inflicted by demons (mental disease); health maintenance, and aphrodisiacs restoring youth. Pulse reading is emphasized and fledgling Vedics study with experienced gurus or have the profession passed to them from studied relatives. Most Indians still resort to Ayurvedic treatment when in need, although the practice has been criticized many times as nonscientific, unprofessional and lacking in the successes of allopathic or Western medicine. The persistence of Ayurvedic practice reflects in great part the importance of the Hindu religion to the Indian population. Without this intermixture of treatment and religion, and the religious sensitivity of the Vedic practitioner, many Indians would feel alone and uncomfortable and probably would seek no medical care at all.

Schools combining indigenous practice with allopathic courses in anatomy, science and medical skills were introduced in the north of India in 1822, by order of the British Viceroy. However, Ayurvedic therapy, although possessed of an enormous pharmacopeia of useful but often unstandardized compounds, still is deficient in technical knowledge and skills. Training of Vedics still relies heavily on drills in Sanskrit grammar, philosophy, rote memorization of verses and production of age-old remedies of questionable modern value. In Tamil Nadu, a variant form of Ayurvedic, called Siddha, is based on texts on alchemy. Indigenous Indian medicine is not taught in allopathic medical colleges. However, Ayurvedics will frequently attend allopathic schools and eventually practice a combination of the two disciplines.

Many of the drug preparations advertised as curative contain a large number of herbs frequently mixed with clarified butter (ghee) and boiled or distilled into semiliquid paste for oral use or external application. However much one may doubt the system, Rauwolfia was an accepted Ayurvedic drug for centuries and legitimate cases of "cures" of hepatitis and arthritis and of drug amelioration of diabetes mellitus fascinate the allopathic physician and intrigue him to further study this carefully guarded pharmacopeia. Vedic practitioners are quick to refer patients with surgical disease, infectious disease and other maladies where they feel their knowledge and skill to be inadequate.

Unani-Tibb, an extension of ancient Greek medicine following the school of Avicenna, moved eastward from Persia to the Indian subcontinent along with the spread of Islamic religion and political influence. Its practitioners (hakims) speak Urdu and are located mostly in the north. Their first professional school was founded in south-central India in Hyderabad in 1890. Similarities exist in the Unani-Tibb and Ayurvedic systems in the study of religious treatises, the use of pharmacologic remedies traditionally handed down by father to son and lack of a large body of technical and scientific knowledge. In Bengal, in the northeast of India, Unani-Tibb hakims are frequently a caste in themselves, the families devoting themselves to this type of care for centuries in similarity to the Vedics who frequently are caste Brahmins and allow for no others to assimilate their knowledge.

An interesting and surprising aspect of the healing arts of Unani-Tibb hakims is the medicinal usage of precious and semiprecious gems. Ground diamonds, garnets, jasper, rubies and Kashmiri sapphires are mixed within different vehicles. Each stone has a specified use for a specific disease. Also, hakim practitioners reduce fractures and then cast the extremity in a green mucoid substance ground from the stem of the plant Cissus Quadrangularis, a botanical relative of the grape. The gummy substance stabilizes the fracture as would a cast. Cissus compounds also are used a poultices to reduce swelling in inflammatory diseases, especially in the parotid gland swelling of mumps.

A uniform similarity of the two systems (Ayurvedic and Unani-Tibb) is in economics (fee for service) and the cost to the patient is usually well within his means, being a few annas at most. Both Ayurvedic and hakim practitioners abound in the large rural areas of India while in the large cities, which account for only 20 percent of India's population, allopathic skills are more frequently sought.

For treatment of acute sinusitis in Madras I sought the aid of an Ayurvedic practitioner since antibiotics were not available. For 10 rupees ($1.20) I received six ounces of a pleasant smell-

ing mixture of ghee, saffron, vinegar and herbs, one of which was the pungent cardamom. One teaspoon twice a day was prescribed. I developed an aggressive nasal discharge which did in fact clear my sinuses and relieve my intense frontal headache, maxillary pain and fever but which also produced a rather distressing diarrhea. I was told on my return that it was written that one could not cleanse the nose without at the same time cleansing the bowels and was quoted a Sanskrit reference which I quickly forgot.

Diseases in India

Life in India is difficult. The average Indian life expectancy is said to be 47 years. The poverty level, into which 50 percent of the Indian population falls, is 96 rupees a month, about $12 per month or $244 per year. Wages are small and the population density is incredibly high. Accordingly diseases are much related to population and hygiene. In Tamil Nadu there exists perhaps the highest incidence of leprosy in the world, 2.3 per 1,000 population. Goiter is endemic because the monsoon rains do not allow for the retention of iodine in the soil or water and no iodination of salt has been implemented. High methionine levels in southwest India (Kerala) have been implicated in a variety of diseases such as calcareous pancreatic diabetes and primary hepatic tumors. In the rural areas of southwest India diet consists principally of tapioca, bananas and coconut and these have been implicated in an inordinate rate of premature coronary disease. The concept that lean muscular hard-working males are immune to coronary disease cannot be substantiated in India. Tropical eosinophilia manifest by asthma, cough and inflammatory changes shown on x-ray studies is assumed due to microfilaria and can be effectively treated with diethylcarbamazone.

The use from childhood of a cud of betel nut, tobacco and lime called "pan" is reflected in the high incidence of epidermoid carcinoma of the mouth and tongue. Pulmonary tuberculosis is said to affect 40 percent of the total Indian population and not infrequently presents with the clinical features of acute pericarditis or pericardial tamponade. Buerger disease producing gangrene of all four extremities is common. A typical operating schedule at a hospital in south India will list three thyroidectomies for goiter, three gastrectomies for peptic ulcers and three amputations for Buerger disease. The latter is felt to be related to the heavy smoking of bidi, a tobacco rolled in a leaf. Bidi production is a cottage industry sponsored by the government and the habit commonly in southern India will find a user smoking 50 to 60 of these small cigarettes a day.

Smallpox appears rare in India now but the facial scars on Indian adults attest to its former presence. (According to the World Health Organization and experts at the Center for Disease Control, no smallpox has been reported in India for about two years.) Rewards for information about active cases are posted on billboards. Cholera and typhoid present continued difficulties especially after natural disasters such as the November 1977 cyclone and tidal wave in Andra Pradesh where some 60,000 to 100,000 people died. With water comes malaria. However, with the birth rate in India of 57,000 per day with a 20 percent perinatal mortality, within three days, this loss was recouped.

However much one is impressed with these diseases, though, their frequency cannot be ascertained because no uniform reporting system and no public health system exist in India. It is unlikely that such will ever be possible because frequently no birth certificates are issued and because the way in which children are named does not allow one to clearly distinguish brother from sister or generation from generation. This is especially evident in the Christian population of southern India where children assume the Christian name of the grandfather with differing Indian surnames.

One of my principal reasons for traveling to India was to see and study the civilization that produced Mohenjo Daro, the Allore and Ajanta cave art, Khajaraho's sculpture, the Taj Mahal and Meenakshi temples, and where a flourishing trade with Greece and Rome existed in the centuries just before and after Christ. I also wanted the opportunity to view cardiology in India and to practice it in an area of the world unknown to me.

Cardiovascular disease in India is as much a problem as hygiene, infection, contaminated water and population explosion. In the Indian population the most common cardiac disorder is acute and chronic rheumatic heart disease. An estimated 20 percent of the rural population has significant valvular involvement. The severity of the disease at a young age is extraordinarily impressive. Patients with severe calcific mitral stenosis are not infrequently seen in their teens and surgical operation, be it commissurotomy or valve replacement, is quite frequently necessary before a

patient reaches the age of 20. Perhaps one of the reasons for the high incidence of rheumatic fever is the paucity of therapy for streptococcal disease. Even in those who have had rheumatic carditis, the recurrence rate is high because adherence to prophylactic antibiotic therapy is poor. Penicillin prophylaxis in India is recommended until the age of 45 because of the frequency of recurrence in adults.

Endomyocardial fibrosis, previously reported as endemic only in East Africa (Kenya and Uganda) is frequently seen in southern India. Obstruction to right ventricular outflow produces right heart failure and ascites which have to an extent been ameliorated by surgical bypass of the right atrium or superior vena cava to the pulmonary artery. Systemic hypertension is common in India and is surprisingly easily controlled by adrenergic blockers and thiazide drugs. Propranolol is now being chemically manufactured in Madras by government agreement with British chemical industries.

Most astonishing to the poorly-informed Westerner or Western cardiologist is the frequency of severe pulmonary vascular disease in India. The pulmonary vascular bed of the Indian population is intensively and tardively reactive. Severe pulmonary hypertension is seen frequently in congenital heart disease with an astonishingly high incidence of the Eisenmenger complex in children and young adults. Rheumatic carditis is endemic and invariably diagnosed clinically. These unfortunate children, as stated, go on in early life to severe mitral valve disease and equally severe pulmonary hypertension which is not completely reduced by surgical commissurotomy or mitral valve replacement. Primary pulmonary hypertension is common as is the Lutembacher syndrome of atrial septal defect with mitral stenosis with an added Asian component of pulmonary hypertension. Perhaps the most impressive indication of pulmonary vascular reactivity in India concerns those patients with coronary artery disease in whom myocardial infarction and subsequent left ventricular failure develop. Not infrequently, these persons are found clinically or by cardiac catheterization analysis to have systemic systolic pressures in the pulmonary artery.

Cardiac surgery in Asia is advanced but at the same time limited. There are only four or five major centers doing such work. The limitation of surgery is paralleled by other deficiencies. There are only three practicing pediatric cardiologists in the country. Cardiopulmonary bypass of over two hours carries a high risk of death from "pump lung." Any bypass pump procedure may be more expensive than most Indians can afford and prosthetic devices such as heart valves and pacemakers are totally outside the ability of patients to purchase. Coronary bypass operations have been carried out in areas of epidemic disease but few statistics as to patient selection, surgical results and long-term survival are available.

In Vellore more than 4,000 closed mitral commissurotomies have been successfully done. The professional cost of this service to a patient is approximately 900 rupees ($115). However, the cost of utilizing the pump oxygenator for implanting prosthetic heart valves may drive the cost of surgery to between 10,000 and 20,000 rupees ($1,250 to $2,500), and an artificial heart valve will require an additional expenditure of 4,800 rupees. The cost of hospital stays for cardiac catheterization ranges from 900 to 1,100 rupees. Cardiac pacemakers manufactured in Hong Kong are less expensive than in the West, yet still cost about 16,000 rupees ($2,000). Government hospitals have the same fiscal obstacles to purchase of prosthetic devices and pacemakers as private facilities.

Pharmacopeia

Allopathic cardiac medications in India are little different from the West with one exception: verapamil. This agent, a papaverine derivative, impressed me greatly. It is widely used in South Africa, Western Europe, New Zealand and Australia and presently is under investigation in this country. This compound which alters the "slow current" of calcium ingress to cells has been described as the "jet-age treatment of supraventricular tachycardia" without effect on cardiac cellular automaticity and with a negligible effect on myocardial contractility. The drug produces high grade antegrade and retrograde atrioventricular block. Supraventricular tachycardia can be reversed in less than five minutes following intravenous injection. On occasion, systemic hypotension due to peripheral vasodilation will occur. When quinidine became virtually unavailable in India in 1973 because of price and decreased supply, verapamil became the treatment of choice in supraventricular tachycardia. In rapid atrial fibrillation, ventricular rate slowing could occur within minutes without the inherent problems of digitalis intoxication. Verapamil is now

used throughout the subcontinent for chronic control of ventricular rate in atrial fibrillation, allowing low-dose digitalis maintenance. Its effect on reentrant tachycardias has been useful in terminating and preventing the occurrence of supraventricular tachycardia in the Wolff-Parkinson-White syndrome as long as the mechanism is not atrial flutter or fibrillation where preferential conduction down the anomalous bypass tract may be facilitated. Recent reports suggest also its effectiveness in controlling the coronary spasm of Prinzmetal variant angina.

Other drugs used in India and of interest to foreigners, yet not concerned with cardiovascular diseases, are thalidomide, rifampin and dapsone, all indicated in various forms of leprosy. Dapsone is the mainstay of therapy for mycobacterium leprae, replacing chalmoogra oil, and if taken early or consistently in chronic lepromatous or tubercular leprosy can be curative. Hemolytic anemia and chronic methemoglobinemia are accepted complications. Rifampin is an ancillary antileprosy agent of considerable effectiveness. The acute erythema nodosum leprae reaction occurring after initiation of leprosy therapy or occurring for reasons unknown as an acute arteritis, neuritis, nephritis or hepatitis can be effectively treated with oral administration of thalidomide. The agent which produced phocomelia in Europe exists as an effective agent in Asia, used only in men or postmenopausal women with the alternative agent in the female reproductive years being corticosteroids. Oddalum, a figwort similar to digitalis purpurea, the standard foxglove, grows abundantly in India. With food a real scarcity in rural areas, intoxication following the ingestion of this plant is common and patients frequently present with symptoms similar to digitalis overdose.

General Impressions

Many other isolated experiences struck me as significant in India. Acute appendicitis as we know it in the West is virtually unknown in India, as is carcinoma of the bowel (perhaps, as Burkitt has inferred, because of a high fiber diet). Birth defects such as kyphoscoliosis and untended club feet are common. So is poliomyelitis and persons with this disease frequently present as paralytic beggars in the large cities. Congenital and traumatically acquired cataracts are common as in some areas is trachoma. In Vellore and in other areas of India dedicated groups of physicians and nurses will mobilize an eye camp in rural areas. It is not uncommon to carry out 100 or more cataract extractions a day, a much more effective form of therapy than that used by inexperienced practitioners who characteristically poke out the lens with an unsterilized needle with ensuing panophthalmitis and blindness. The quality of care of these traveling medical suites is exemplary.

Reconstructive surgical procedures for leprosy are a triumph over a disease first documented in the Hebrew Bible. Hands and feet deformed by traumatic bone resorption and ulcerations due to loss of sensation and proprioception can be straightened into functional positions by muscle and tendon transplantation. Braces, uniquely devised shoes and electronic pressure sensors all are employed to rehabilitate those patients unfortunate enough to have missed curative drug therapy in early life. Neural paralysis of the orbicularis oculis muscle causes a failure of the blink reflex leading to corneal drying, ulceration and frequently secondary blindness. A uniquely simple if not brilliant surgical procedure now allows the restoration of blinking and lubrication of the cornea by attaching the orbicularis oculis muscle to the masseter. When the leper chews, he blinks and vision is saved.

Psychiatric problems are common in India. The incidence of schizophrenia is equivalent to that of the rest of the world. In India, however, with its age-old tradition and culture and its veneration of meditation, experience, visions and god-oriented forces, the subject seeing visions and hearing voices may be tacitly approved as a holy man and not as a psychotic. The psychiatric problems requiring therapy are not unlike those of Vienna in the 1890's and hysteria and conversion reactions are quite common.

Asian history does not comment on African invasion or migration although this is surely possible with the suspected prior land bridge between Africa and Asia and with the Mogul-Islam relocation into India in the 8th century. Whether such miscegenation is at fault or not, sickle-cell disease in dominant and recessive form exists in apparent caucasian (Aryan) populations of northeast India and in as many as one third of the primitive Veddoid hill tribes of southern India. The disease, even in its dominant expression, is considerably milder than in Africa. In the south of India where malaria may be frequent, heterozygotes for the sickle hemoglobin are not protected from the falciparum parasite as they are in Africa. Altered

immunity of a sort seems also to be an important factor in the development of leprosy; patients with active mycobacterial disease seem to have altered cellular immunity.

Indian medicine seems to mirror and adapt to the practices of the West. The latest studies in Western journals are used to enhance medical treatment. Indian publications are in the main quite good, clinically oriented and intended to teach practitioners how to deal in contemporary expertise with common problems. Research in India seems, however, to be directed towards opposite ends of a spectrum. At the All India Medical Institute in Delhi, I observed advanced tissue culture techniques, hemodynamic and electrophysiologic techniques in investigative cardiology as well as many other types of basic science investigation. However, in Vellore and at the Shri Chitra Tirunal Clinical Research Center in Trivandrum (Kerala), clinical research and teaching were emphasized. The latter institution is a combined project in clinical research in neurology and cardiology jointly sponsored by the Indian Central Government and by contributions from the family of the former Maharajah of Trivangore. Here there is an impressive program of medical-industrial research to produce artificial heart valves of durability but made of available Indian metal and textiles to overcome the prohibitive price of foreign-import prosthetic valves.

Afterthoughts

What is the value of travel to an area of the world that most Westerners consider backward, dirty and disadvantaged? First, one dissolves the myth that Western civilization is the model to which all should be molded. The sheer age of Indian cultural tradition and heritage is awesome when we consider as Americans that we have only recently celebrated our bicentennial. Indian civilization predates our society by thousands of years and offers alternatives to the vast and complicated civilization within which we live. This is not to say that India itself is not a complex country. Nowhere in the world is there a more staggering political and industrial inefficiency and bureaucratic chaos than in what has been called the world's largest democracy. Yet where else in the world today can you feel safe in teeming, crowded cities? Where else are people spiritually at peace with themselves, do not fear death and with so few material possessions live and die gracefully? Indians are basically a happy joyful race. India may be dirty but nowhere is there litter; every stick, paper, leaf or can is used for household functions. Second, in India a physician can practice medicine in a scientific fashion unbothered by the concerns of time pressures and emergencies, of unpleasant responsibilities, of legal adversaries, paper bureaucracy, and patients with imagined illnesses and petty complaints. Stress within the medical profession is at a minimum. Medicine in India is a true profession of problem solving, deduction and prescribing which formerly existed in the Western world. Third, India represents a refreshing aspect of medicine where the problems and their solutions are basically evident. However, to carry out this vision of medical care is complexly difficult because of age-old social biases, racial and caste hatreds, religious conflicts, fiscal shortages, crushing overpopulation and political obstacles. In these obstacles to health care the actual practice of medicine becomes complex and perhaps little different from that throughout the Western world.

I found Indian doctors, nurses, technicians, basic scientists and students no less a part of the 20th century than ourselves. With an overwhelming responsibility to care for more than 640 million patients with limited funds and equipment, they utilize their minds and their hands with little recourse to technical and laboratory aids, and they use their resources both frugally and scientifically. India is primitive by our standards but open to most scientific investigation. An American immunopathologist from Cornell University working in Trivandrum expressed it in the following way: "you can take frozen serum from this country to the United States and study basic disease mechanisms important to world health." Knowledge of Asian and Indian medicine is important not only for discovering disease mechanisms but for discovering yourself in the world in which you live.